Table 2.6.1. Ground-Water Quality Summary

Parameters	P-2	P-4	GW-8
Temp (oC)	13	17.0	13
pH	7.7	7.65	7.0
Sp. Cond. (umhos/cm)	2,416	21,700	7,543
Depth to Water (ft)	9.18	8.49	27.86
TOC (mg/l)	24	106	103
TOH (ug Cl/l)	56	244	314
TDS (mg/l)	1,695	22,100	7,622
COD (mg/l)	94	191	713
Ca++ (mg/l)	52.7	443	470
Mg++ (mg/l)	27.4	555	316
Na+ (mg/l)	512	5,800	1,602
K+ (mg/l)	4.6	11.8	28
HCO3- (mg/l)	884	1,660	1,154
CO3= (mg/l)	1	<1	<1
SO4= (mg/l)	469	13,800	4,027
Cl- (mg/l)	39	162	429
NO2- as N (mg/l)	0.02	0.02	0.18
NO3 as N (mg/l)	33	2.3	5.0
NH3 as N (mg/l)	0.07	0.30	0.4
Cd (mg/l)	0.003	<0.005	0.012
Fe (mg/l)	<0.03	<0.03	1.16
Pb (mg/l)	<0.05	<0.05	0.08
Mn (mg/l)	0.02	<0.05	0.92
Hg (mg/l)	0.001	<0.0003	0.0025
Zn (mg/l)	0.01	<0.05	0.03

Note: Values are arithmetic means of all data available, up to and including September 1993.

Table 2.6.1. Ground-Water Quality Summary (continued)

Parameters	S-205	S-208	S-209	S-210
Temp (oC)	13	15	14	14.7
pH	6.8	8.0	7.6	7.4
Sp. Cond. (umhos/cm)	8,570	3,830	4,060	4,145
Depth to Water (ft)	35.64	146.02	82.03	164.78
TOC (mg/l)	217	56	65	31
TOH (ug Cl/l)	28	389	31	147
TDS (mg/l)	7,677	2,359	2,831	2,447
COD (mg/l)	461	179	173	138
Ca++ (mg/l)	314	39.0	64.9	49.1
Mg++ (mg/l)	137	10.2	16.4	12.1
Na+ (mg/l)	2,008	815	971	890
K+ (mg/l)	13	21	7.8	10
HCO3- (mg/l)	1,603	480	1,482	429
CO3= (mg/l)	<1	<1	<1	<1
SO4= (mg/l)	3,544	128	349	6
Cl- (mg/l)	409	1,057	557	1,292
NO2- as N (mg/l)	0.03	0.01	0.01	0.03
NO3 as N (mg/l)	0.1	<0.04	0.1	0.1
NH3 as N (mg/l)	2.19	2.17	2.7	2.04
Cd (mg/l)	0.006	0.003	<0.005	<0.005
Fe (mg/l)	1.70	0.30	0.10	0.12
Pb (mg/l)	<0.05	<0.05	<0.05	<0.05
Mn (mg/l)	0.76	0.87	0.11	0.49
Hg (mg/l)	<0.0003	<0.0003	<0.0003	<0.0003
Zn (mg/l)	0.02	0.01	0.01	0.01

Note: Values are arithmetic means of all data available, up to and including September 1993.

Table 2.6.1. Ground-Water Quality Summary (continued)

Parameters	P-3	S-203	S-204
Temp (oC)	12.8	14	14
pH	7.5	8.1	7.7
Sp. Cond. (umhos/cm)	5,772	2,718	2,672
Depth to Water (ft)	27.87	101.22	87.75
TOC (mg/l)	26	46	13
TOH (ug Cl/l)	84	85	25
TDS (mg/l)	4,510	1,909	1,632
COD (mg/l)	65	135	74
Ca++ (mg/l)	141	23.1	20.4
Mg++ (mg/l)	79.2	7.0	5.7
Na+ (mg/l)	1,239	705	626
K+ (mg/l)	19	10	4.8
HCO3- (mg/l)	1,256	1,422	900
CO3= (mg/l)	3	20	4
SO4= (mg/l)	2,165	194	78
Cl- (mg/l)	161	163	465
NO2- as N (mg/l)	0.1	0.02	0.01
NO3 as N (mg/l)	6	3.5	0.1
NH3 as N (mg/l)	0.08	1.30	1.61
Cd (mg/l)	<0.005	<0.005	0.004
Fe (mg/l)	0.02	0.10	0.04
Pb (mg/l)	<0.05	<0.05	<0.05
Mn (mg/l)	0.06	0.15	0.08
Hg (mg/l)	<0.0003	<0.0003	<0.0003
Zn (mg/l)	<0.01	0.01	<0.01

Note: Values are arithmetic means of all data available, up to and including September 1993.

Table 2.7.1. Summary of Well Yields

Ref. No.	Permit Number	LOCATION 1/4-1/4	Section	Owner	Use	Depth (feet)	Water Level (feet)	Yield (gpm)	Aquifer
1	31502F	NWSW	21	Landfill Systems	DC	700	300	8	KLF
2	38451F	NWNE	29	Laidlaw Waste Systems	DC	690	200	15	KLF
3	38450F	NENW	29	Laidlaw Waste Systems	C	800	250	30	KLF
4	10923AD	SWNE	31	Keith, R.	D	-	-	-	KLF
5	14781MH	SE	31	Smith Energy Services	O	-	-	-	GW
6	10922AD	NWSE	31	Dent, W. V.	D	-	-	-	KLF
7	15937	NESW	31	Jungferman, Valdamar	D	480	140	10	-
8	10675F	SWSE	32	Field Enterprises	M	875	30	25	-
9	37456F	NESW	32	Pezolot, Allen E.	DC	660	200	18	KLF
10	63868	NESW	32	Smith, Marshall D.	DS	310	120	10	-
11	72111	NESW	32	Crotty, Leo E.	D	660	200	15	KLF
12	90524	NESW	32	Howe, Dolores Betty	H	320	100	6	-
13	70304	NWSW	32	Picraux, Lyle J.	D	515	215	6	-
14	151382	SWSW	32	Jenkins, Thomas	A	-	-	-	KLF
15	96121	SWSW	32	Picraux, Lyle J.	C	740	90	15	-
16	91146VE	NESW	32	Tillman, B. & Lewis J.	DS	-	-	-	GW
17	115153	SE	33	Rockwell, L. H.	DS	-	-	-	-
18	10630	NENE	33	N. Huron Water Co.	M	-	-	-	KLF
19	27743	NWNE	33	Porter, Lawrence	D	894	135	30	-
20	38854	NWNE	33	Kailer, Fred F.	D	63	9	1	-
21	58621	NWNE	33	West, Wilson	D	889	120	15	-
22	56474	NWNE	33	West, Wilson	D	-	-	-	GW
23	118667	NWNW	33	Poole, R. N.	D	-	-	-	-
24	138952	SWNW	33	Reinholdt, John R.	C	-	-	-	KLF
25	23394	SESE	33	Muhle, Walter	D	250	135	20	-
26	34971	SESE	33	Muhle, Walter	D	390	120	20	-
27	115153	SW	33	Elzi, Jr., Charles J.	DS	700	-	15	-
28	138951	SWSW	33	Reinholdt, John R.	C	-	-	-	KLF
29	38853	NENW	33	Kinkel, Allen J.	D	103	-	-	-
30	-	SESW	33	Brownlee, Robert	H	-	-	-	KLF

Notes:

Use Codes are as follows.

C - Commercial
D - Domestic
H - Household use only
M - Municipal
S - Livestock
O - Other

3.0 MONITORING PLAN

3.1 GROUND-WATER MONITORING NETWORK

3.1.1 Monitoring Well Placement

The ground-water monitoring system consists of nine wells near the waste management unit boundary (Figure 2.1.2.1). The saturated soil at P-2, fractured bedrock at GW-8 and the No. 6 Coal are considered the uppermost aquifer for monitoring purposes. The deeper bedrock systems will also be monitored to establish background at upgradient locations where the No. 6 Coal is absent. The wells and the ground-water systems which they monitor are as follows.

System		Wells	Hydraulic Position
Soil		P-2	down-gradient
GW-8 Fractured Zone		GW-8	down-gradient
		S-211	down-gradient
No. 6 Coal		S-205	side-gradient
		S-208	down-gradient
		S-209	down-gradient
Deeper Bedrock	P-3 Sandstone	P-3	up-gradient
	Lower Sandstone	S-204	up-gradient
	Lower Coal	S-203	up-gradient

Pending the results of future monitoring, GW-8 may be abandoned and conditions in the fractured zone monitored by sampling S-211. An additional ten wells (P-1, P-4, S-101, S-102, S-105, S-106, S-201, S-202, S-206, and S-212) will be checked for the presence of water and sampled if they contain sufficient water for chemical analysis. The ground-water monitoring wells are described in detail in Doty (1991f, 1992d, 1994b, and 1994d).

As required by CDH (1988), routine post-closure monitoring is also conducted for the Old Erie Landfill by Laidlaw. The monitoring network consists of GW-1, which is completed in a coal, and S-210, which is completed in the No. 6 Coal. Both GW-1 and S-210 routinely produce sufficient water for chemical analysis. In addition, GW-7 and GW-12 will be checked for the presence of water and sampled if they contain sufficient water for chemical analysis. Sampling and analysis will be performed according to the schedule and for the parameters specified for the monitoring network at the Denver Regional Landfill. This will constitute a change from the currently approved schedule (quarterly) after background has been established. In compliance with CDH (1988), monitoring of the Old Erie Landfill will continue until January 1998 or through the active life of the Denver Regional Landfill (South), whichever is longer.

3.1.2 Well Construction Details

Well Construction Data - In general, the monitoring wells have been designed and constructed in accordance with the State of Colorado Water Well and Pump Installation Contractors Act, Title 37-91-1, C.R.S. 1973, as amended. In addition, the design and construction conform with ASTM standards for monitoring well installation (ASTM, 1990). All of the S- and P-series wells are constructed with threaded PVC and inert completions materials. The GW-series wells are also constructed with PVC; however, solvent cement may have been used. Surveyed location and elevation data are provided in Table 3.1.2.1. Construction details are summarized in Table 3.1.2.2 and shown on the completion diagrams presented in Appendix C.

Historical Water Level Data - Water levels have been measured at least quarterly in each monitoring well. A summary of the water level measurements in wells yielding measurable quantities of water is given in Table 3.1.2.3.

Rate of Well Recovery - Recovery rates were measured in the S-series wells at the end of development. The rates of well recovery are presented in Table 3.1.2.4.

Well History - Historical information is well documented for the S-and P-series wells (all of these wells were installed during Laidlaw's ownership of the site). Less information is available for the GW-series well histories. A summary of historical information is presented in Table 3.1.2.5. Recent maintenance activities are as follows.

- The surface completion of well S-203 was damaged and repaired in August, 1991 (Doty, 1991e). The repair consisted of replacing a short length of the PVC casing sticking up above the ground surface and installing a new protective casing around the well.
- In March of 1994, wells P-3, P-4 and S-204 were extended to conform with the new ground surface in an area under construction for expansion of the site. New surface completions were made at each well location and were similar to the original surface completions (Doty, 1994c).

3.1.3 Monitoring Well Inspection and Maintenance

The condition of the wells will be inspected each time water levels are measured. The inspection will be documented on the Ground-Water Sampling Field Data Sheet (Figure 3.1.3.1), which will be kept on file at the facility. The inspection will consist of an evaluation of the following.

☐ Is the well number clearly labeled on outer casing or lid?

☐ Is well permit number (if applicable) permanently affixed to well?

☐ Is protective casing intact and not bent or excessively corroded?

☐ Does weep hole adequately drain well head?

☐ Is concrete pad intact (no evidence of cracking or heaving from frost)?

☐ Is padlock functional?

☐ Is inner casing intact?

☐ Is inner casing properly capped and vented?

Any damage or degradation will be repaired, if possible. If the well cannot be repaired and the integrity of samples or water level measurements may be impaired, the well will be decommissioned and replaced following the Water Well and Pump Installation Contractor's Act (Title 37, Article 91, Part 1, CRS as amended).

Periodically, the turbidity of the ground-water samples will be evaluated to determine if they are representative of subsurface conditions. If the water is too turbid, the well may be redeveloped, if appropriate. Alternatively, sampling methodologies may be changed to minimize sample turbidity.

The turbidity of samples currently being collected by bailing is fairly high. Samples were collected from eleven wells for turbidity analysis by EPA Method 180.1 (EPA, 1979) in June, 1994. The turbidity samples were collected at the end of the routine monitoring field work in order to obtain samples representative of those typically submitted for analysis. Nine of the eleven samples have turbidities exceeding the EPA acceptance value of five nephelometric turbidity units (EPA, 1986a). Fine grained materials in the completion intervals are probably the source of the turbidity in the samples. The wells producing the two acceptable samples are completed in soil (P-2) and a very shallow sandstone (P-3).

Additional development of the wells producing the turbid samples is not likely to reduce sample turbidity because of the following.

- The S-series wells have already been extensively developed.
- The development methods should have been adequate to remove fine grained materials from the sand pack and near-well subsurface, if development were possible. Bailers have been used for both the original well development and subsequent routine sampling (nearly three years). Bailers are recognized as providing the benefits of both over-pumping and surging (Aller et al., 1990).
- Extremely large volumes have been removed from the wells by bailing over the years. GW-1 has been sampled a minimum of 32 times for routine monitoring since September 1986. This corresponds to a total purged volume of 320 to 480

gallons. Nonetheless, the GW-1 sample had a turbidity of 160 nephelometric turbidity units (the highest of all the samples).

Thus, additional development by means of surging or bailing is not expected to effectively develop wells completed in the fine grained materials beneath the site. A potentially more effective means of reducing sample turbidity is the use of alternative sampling equipment. Sampling equipment and methods are discussed in Section 3.3.4.

3.2 PARAMETERS AND SCHEDULE

3.2.1 Detection Monitoring

Determination of Background - In accordance with the State of Colorado regulations (6 CCR 1007-2), eight quarterly samples will be collected from each well and analyzed for the Appendix IA & IB constituents to establish background ground-water quality. The first set of detection monitoring samples was collected in December, 1993; therefore, determination of background will continue through December, 1995.

Subsequent Sampling Events - ~~Following the initial (two year) background sampling~~ period, ground-water samples will be collected from each well on a semi-annual basis. If a statistically significant increase over background for any of the Appendix IA and IB constituents is indicated, Laidlaw will do the following.

- Immediately (within 7 days) collect a verification re-sample.
- Within 14 days of confirmation of the statistically significant increase based on the re-sample results, place documentation in the operating record indicating which constituents have shown statistically significant changes from background levels and forward the documentation to CDH and the Weld County Health Department.
- Within 90 days, establish an assessment monitoring program meeting the requirements of 40 CFR 258.55 unless it can be demonstrated that a source other than the MSWLF unit caused the contamination, that the statistically significant increase resulted from an error in sampling, analysis, or statistical evaluation, or that the statistically significant increase resulted from natural variation in ground-water quality. A report documenting this demonstration must be certified

by a qualified ground-water scientist, placed in the operating record, and approved by CDH and Weld County.

If a successful demonstration is made and documented, detection monitoring will be continued. If, after 90 days, a successful demonstration is not made, an assessment monitoring program will be initiated.

3.2.2 Assessment Monitoring

Within 90 days of triggering an assessment monitoring program, and annually thereafter, Laidlaw will sample and analyze the ground water for all constituents identified in 6 CCR 1007-2 Appendix II. This list is identical to the Appendix II list in 40 CFR Part 258. A minimum of one sample from each potentially affected well will be collected and analyzed during each sampling event. If any Appendix II constituents are detected, a minimum of four independent samples will be collected from each well and analyzed to establish background concentrations for the constituents. The background samples will be collected on a quarterly basis in order to achieve sample independence. CDH may specify an appropriate subset of wells to be sampled during assessment monitoring and may delete any of the Appendix II monitoring parameters if it can be demonstrated that these constituents are not reasonably expected to be in or derived from the waste contained in the unit.

After obtaining the results from the sampling events described in the paragraph above, the facility will do the following:

- Within 14 days, place documentation in the operating record identifying the detected Appendix II constituents or the list approved in accordance with 40 CFR 258.55(C) and submit the documentation to CDH and Weld County.

- Within 90 days, and on at least a semiannual basis thereafter, resample all wells (background and downgradient) for analysis of all constituents in Appendix IA & IB or in the alternative list approved by CDH, and for those constituents in Appendix II, or the list approved by CDH, which were detected. The concentrations will be recorded in the facility operating record and submitted to CDH and Weld County.

- At least one sample from each well must be collected and analyzed during these sampling events. CDH may specify an alternative monitoring frequency during the active life (including closure) and the post-closure period. The alternative frequency for Appendix IA & IB constituents, or the list approved by CDH, during the active life (including closure) shall be no less than annual.

If the concentrations of all Appendix II constituents are shown to be statistically at or below background values for two consecutive sampling events, Laidlaw will document and submit this finding to CDH and Weld County and may, upon approval from CDH, return to detection monitoring.

If one or more Appendix II constituents or the list approved by CDH are detected at statistically significant levels above the background concentrations, Laidlaw will, within 14 days of this finding, place a document in the operating record identifying the Appendix II or approved list constituents that have exceeded the background concentrations and submit the documentation to CDH and Weld County. Laidlaw will also:

- Characterize the nature and extent of the release by installing additional monitoring wells as necessary.
- Install at least one additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well in accordance with 40 CFR 258.55(D) (2).
- Notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination if contaminants have migrated off-site.
- Initiate an assessment of corrective measures as required by 40 CFR 255.56 within 90 days.

Even if a successful demonstration is made that a source other than the MSWLF unit caused the contamination, or that the statistically significant increase resulted from an error in sampling, analysis, or statistical evaluation, or natural variation in ground-water quality, assessment monitoring will continue until the Appendix II or the approved list constituents are at or below background concentrations. After the Appendix II or the approved list constituents are at or below background concentrations, Laidlaw will return to detection monitoring. A report documenting this demonstration must be certified by a qualified ground-water scientist or approved by CDH and placed in the operating record.

Until a successful demonstration is made or if a demonstration cannot be made, Laidlaw will comply with 40 CFR Part 258.55(G), including the initiation of an assessment of corrective measures in accordance with 40 CFR Part 258.56. The assessment of corrective measures, selection of a remedy based on the results of the corrective measures assessment, and the actual implementation of the corrective measures are outlined in detail in Appendix B of 6 CCR 1007-2.

3.3 GROUND-WATER SAMPLE COLLECTION

Prior to each monitoring event, either the General Manager or Operations Manager will be notified of the monitoring schedule. If necessary, the General Manager or Operations Manager will provide a key to the wells and access to restricted areas. Additionally, monitoring personnel will sign in at the office each day upon arrival and sign out before leaving. The monitoring personnel will not interfere with the routine operations and will comply with all site rules and regulations, in addition to the procedures in this document.

3.3.1 Preparatory Activities

All sampling equipment, forms and containers will be organized in the office prior to commencing field work.

Sampling Sequence - The sequence of sampling has been selected to maximize the sample volume collected, while minimizing the time between well purging and sample collection. In addition, background wells will be sampled first, progressing to the downgradient detection monitoring wells. If any wells are contaminated, these wells will be sampled last. Thus, the order of sampling is as follows.

	Purge	Sample
Day 1	S-203	S-203
	S-204	S-204
	S-205	S-205
	S-209	S-209
Day 2	-	S-203
	S-210	S-210
	GW-1	GW-1
	P-3	P-3
	P-2	P-2
Day 3	-	S-210
	-	P-3
	-	P-2
	S-208	-
	S-211	S-211
	GW-8	-
Day 4	-	P-3
	-	P-2
	-	S-208
	-	GW-8
Day 5	-	S-208
	-	GW-8

Initiation of Field Data Records - Field data sheets will be initiated prior to the start of sampling. Examples of initial data to be recorded include site and sampling location identification, well depth and construction, and purging and sampling collection methods.

3.3.2 Preparatory Field Activities

The following procedures will be conducted in the field prior to well purging and sampling.

Well Maintenance Check - A well maintenance check that includes a visual inspection of the condition of the protective casing and surface seal will be performed, as described in Section 3.1.3. In addition, the well will be inspected for other signs of damage or unauthorized entry.

The monitoring wells will <u>not</u> be probed for total depth each time they are sampled. Routine sounding of the well can increase the risk of inadvertent well contamination because it is difficult to adequately decontaminate the tapes used for this purpose. Well depths obtained from well completion records are adequate for the purpose of the determination of well volume.

Preparation of Well Area - A suitable work area will be established around the perimeter of the well. This will provide a clean surface on which sampling equipment can be placed such that it will not become inadvertently contaminated. This work area will be prepared by placing new polyethylene (PE) sheeting on the ground around the well, taking care not to step on it. Alternatives can include the placement of a clean PE lined trash can or a clean PE covered table adjacent to the well.

Water Level Measurements - The depth to water will be measured prior to initiation of sampling activities. The water level measurements will be made with an electronic depth-indicating meter following the methodology described below. Water level measurement devices should <u>not</u> be used in the well after it has been purged prior to sample collection. However, limited water level measurements may be made during purging in order to monitor well drawdown if the probe is thoroughly decontaminated prior to use.

The electronic depth-indicating meter is used by lowering the probe into the well until the meter indicates that water has been contacted by the probe. The probe should be raised above the water level and slowly lowered again until water is indicated. The cable should be held against the side of the inner protective casing at the point designated for water level measurements (north side) and a depth reading recorded to the nearest 0.01 feet.

The electronic depth measurement probe will be decontaminated prior to being used in each well. The following procedure will be followed:

1. Wash in potable water and laboratory detergent.
2. Rinse with potable water.
3. Rinse with deionized water.

Calculation of Well Volume - The volume of water standing in the well will be calculated using the measured depth to water, the known well depth, and the well diameter using the constants presented below. Well depth data from the well completion records are generally sufficiently precise for calculating purge volumes.

Well Diameter (inches)	Gallons per Foot of Water
1.0	0.041
1.25	0.064
2.0	0.16
3.0	0.36
4.0	0.65
6.0	1.50

3.3.3 Well Purging and Sample Collection

Monitoring wells must be purged prior to the collection of aqueous phase samples. Well purging ideally results in the collection of a sample that has not been standing in the well or has not been in contact with the well casing, screen, or sand pack materials for a significant period of time. Proper purging is crucial in the collection of a representative ground-water sample.

Equipment Selection - Purging and sampling equipment will consist of a combination of dedicated bladder pumps, dedicated teflon bailers, dedicated closed end PVC bailers and disposable polyethylene bailers depending on the recharge rate of each monitoring well and in general accordance with Figure 3.3.4.1. Wells with moderate to high recharge rates and adequately thick water columns (wells GW-1, S-204, S-205, S-209 and S-210) will be purged and sampled with dedicated bladder pumps. Low recharge wells (GW-8, P-2, P-3, S-203, S-208 and S-211) will be purged and sampled with dedicated teflon bailers or dedicated closed end PVC bailers on new polypropylene rope. The remaining wells in the monitoring system which periodically produce enough fluid for sample analysis will be purged and sampled with disposable polyethylene bailers on new polypropylene rope. Characteristics of purging and sampling equipment are summarized in Tables 3.3.3.1 and 3.3.3.2.

Well Purging - The moderate to high recharge wells will be purged until the indicator parameters stabilize in comparison to initial readings made at the start of purging. The indicator parameters will include pH, conductivity, and temperature. The low recharge wells will be purged dry and allowed to partially recover (often 12 to 24 hours) before sample collection.

Purge Water Disposal - In general, purge water will be disposed of on the ground surface near the well from which it came. Purge water from wells known to contain contaminants (e.g., VOCs in GW-8) will be containerized and recirculated onto covered areas of the fill that are underlain by the composite liner system.

Sample Collection - Sample collection will occur as soon practical after purging, depending on the well recharge rate; however, all samples will be collected within 48 hours of purging. If the required sample volume cannot be collected immediately after purging, the bailer will be removed from the well and stored in clean PE while the well recovers. New polypropylene rope will be attached to the bailer every time the well is sampled. Before a bailer is placed in a well for purging or sample collection, it will be rinsed with deionized water. In addition, a flow regulating device will be attached to the bottom of the bailer to transfer the collected fluid to the sample bottles. The flow regulating device will help to minimize volatilization and reduce contact of the sample with the sampling equipment. When sampling is completed, the dedicated bailers will be rinsed with deionized water, wrapped in clean PE and placed in PVC bailer holders for storage. Disposable bailers will be placed with the normal refuse on site. Specific instructions for the use of sampling equipment are presented in Section 3.3.4.

Sample containers will be filled in a particular order. The order is determined on the basis of parameter sensitivity to volatilization and pH change and the priority for analytical data in cases where the water volume in the well is less than that required for complete analysis. The order of sample collection is as follows.

1. Volatile organic compounds (VOC)
2. Purgeable organic carbons (POC)
3. Purgeable organic halogens (POX)
4. Total organic halogens (TOH)
5. Total organic carbon (TOC)
6. Base neutrals/acid extractables (BNA)
7. TPHC/Oil & Grease
8. PCBs/Pesticides
9. Total Metals
10. Dissolved Metals
11. Phenols
12. Cyanide
13. Sulfate and chloride
14. Turbidity
15. Nitrate and ammonia
16. Preserved inorganics
17. Radionuclides
18. Non-preserved inorganics
19. Bacteria
20. pH
21. Specific conductance
22. Temperature

3.3.4 Equipment Instructions

This section provides specific instructions for the installation and use of the equipment that will be used for well purging and sample collection.

Bladder Pump - A bladder pump will be used for both well purging and sample collection in the moderate to high recharge wells. An inflatable packer may be used in conjunction with the bladder pump to minimize the volume necessary to accomplish effective purging.

Required Equipment:

- Bladder pump
- Tubing of appropriate length
- Bladder pump controller
- Compressed air source
- New disposable gloves of appropriate material
- Plastic sheeting
- Five gallon pail, graduated in one gallon increments

Installation Instructions:

- Lay plastic sheeting on the ground around well.
- Don a new pair of gloves.
- Assemble the pump and tubing and lower into the well being careful not to contact any surface other than the interior of the well or the plastic sheeting. The pump will be placed several feet above the bottom of the well. However, vertical placement is not critical provided that the pump is not moved between the purging and sampling operations.
- Install the air inlet and water discharge fittings on top of the well.

Purging instructions:

- Refuel the gasoline-powered compressor, if used, at a location that is remote from the well, being very careful not to spill any fuel on equipment or clothing to be used at the well site.
- Place the gasoline-powered compressor as far from the well as possible in a down-wind direction.
- Connect the compressed air source and pump controller to the pump as per manufacturer's instructions. Start the compressor.
- Don a new pair of gloves after handling the gasoline-powered compressor.
- Determine the volume of water to be purged.

- Start the pump by opening the regulator on the controller, which allows compressed air to flow into the system.

- Adjust the controller to maximize the flow rate while minimizing the rapid "jolting" of the tubing as water is drawn into the pump.

- Direct the pump discharge to the five gallon pail and determine the pumping rate.

- Continue pumping until the necessary volume of water has been removed from the well.

Sampling instructions:

- Allow the well to recover after completion of purging, if necessary.

- Resume pumping after adjusting the regulator to the minimum pressure that will pump water to the surface.

- Collect the samples by pumping directly into each of the required containers.

- Fill the sample containers in the specified order.

Bailer - A bailer will be used for sample collection in the low recharge wells upon completion of well purging with the same bailer.

Required Equipment:

- Disposable PE or dedicated Teflon® bailer
- Polypropylene bailer cord
- New disposable gloves of appropriate material
- Clean trash can and supply of trash can liners or PE sheeting
- Bottom emptying device (optional)

Purging Instructions:

- Prepare the well area.

- Provide the trash can with a new plastic liner and place adjacent to well (if used). Alternatively, lay plastic sheeting on the ground around well.

- Don a new pair of gloves.

- Attach cord to the bailer using a bowline knot.

- Lower the bailer into the well until it is completely submerged. The bailer will be lowered slowly so as not to cause a splash that could aerate the water.

- Allow the bailer to fill slowly and then gently retrieve the bailer from the well while avoiding contact with the sides of the well. Care will be taken to prevent the bailer or the line from contacting any surface other than the interior of the well, the PE sheeting, or the plastic trash can liner (if used).

- Pour the bailed fluid into graduated pail or bucket and record the total volume purged from well.

- Pour purged fluid from pail onto the ground surface or place in appropriate container for recirculation.

Sampling Instructions:

- Prepare the well area.

- Provide the trash can with a new plastic liner and place adjacent to well (if used). Alternatively, lay plastic sheeting on the ground around well.

- Don a new pair of gloves.

- Attach cord to the bailer using a bowline knot.

- Lower the bailer into the well until it is completely submerged. The bailer will be lowered slowly so as not to cause a splash that could aerate the water.

- Allow the bailer to fill slowly and then gently retrieve the bailer from the well while avoiding contact with the sides of the well. Care will be taken to prevent the bailer or the line from contacting any surface other than the interior of the well, the PE sheeting or the plastic trash can liner (if used).

- Fill the sample containers slowly. A bottom emptying device will be used to minimize sample aeration and volume loss.

- Fill sample containers in the specified order.

3.3.5 Field Quality Assurance/Quality Control Samples

Quality control procedures will be followed so that laboratory preparation, sampling, and transport activities do not bias the results of the chemical analysis. Trip blanks, equipment blanks and field duplicates will be prepared and analyzed as described below to provide a quantitative basis for validating the analytical data.

Trip Blanks - A trip blank will consist of an analyte-free water sample prepared by the laboratory and will accompany the sample container shipment from the laboratory to the field and back. Trip blanks will be subject only to volatile organic analysis. Trip blanks will be collected at a rate of one per monitoring event.

Equipment Blanks - Equipment blanks will consist of analyte-free water that is poured over precleaned sampling equipment (including disposable and dedicated bailers), where applicable. One equipment blank will be collected annually.

Field Duplicates - Field duplicates will consist of an extra full sample collected from one of the high recharge wells. The sample will be submitted to the laboratory and analyzed as any other sample. The sample will not be identified as a duplicate; thus, it will be a blind duplicate. Field duplicate samples will be submitted at Laidlaw's option, as may be needed to validate laboratory performance.

3.3.6 Sampling Preservation and Shipment

Sample Containers and Preservatives - The sample containers and associated preservatives will be selected following applicable EPA and state guidance. The containers and preservatives are normally, but not always, supplied by the laboratory. The sample containers will be organized and inventoried several days prior to initiation of sampling in order to provide sufficient time to rectify any problems, should they occur. Different combinations of containers and preservatives are required for the various analytes and each analyte or group of analytes has a maximum allowable holding time.

The various required preservation methods, container types, and holding times are listed on Table 3.3.6.1.

Sample Labels - Pre-printed sample labels will be placed on all sample containers for the primary purpose of sample identification. Field data need not be recorded on the labels because they will be recorded on field data sheets. The sample labels will contain the following information:

- Sample or location identification number (i.e., well number or arbitrary sample number)
- Analysis to be performed
- Preservation
- Date and time of sample collection
- Initials of sampler

Sample Shipment - All samples will be promptly shipped to the analytical laboratory. The samples will be properly packaged in order to protect the sample containers, to maintain the samples at a temperature of 4°C, and to comply with applicable transportation regulations.

In general, the samples will be shipped using packaging supplied by the analytical laboratory. The packaging normally includes a shippable insulated box (e.g., an ice cooler) and contains protective internal packaging material such as foam sleeves. Some laboratories use proprietary sample packaging with integral internal packaging. In either case, the temperature of the samples will be maintained by the use of ice packs or ice. The shipment of environmental samples is not regulated under 40 CFR 261.40(d); therefore, no special shipping procedures are required. However, sample containers will be properly packed such that inadvertent spillage does not occur during shipment.

On the other hand, there are specific regulations for the shipment of many reagents that are commonly used as preservatives and decontamination agents. Consequently, the shipment to the field site of empty sample containers containing small quantities of preservatives must be conducted in accordance with the regulations. The most significant limitations for the shipment of preservatives (IATA, 1992) involve those for nitric acid in which only small quantities (<0.5L) of low concentration nitric acid (<20%) can be shipped in a single shipment by air.

3.3.7 Chain-of-Custody

Chain-of-custody procedures will be used to track the sample from the time of collection until it, or its derived data, is used. A sample is considered "in custody" under the following conditions.

- The sample is in the actual physical possession of authorized personnel.
- The sample is in the view of authorized personnel after being in physical possession.
- The sample is in a locked, secure area to which access is limited to authorized personnel.

A chain-of-custody form will be initiated at the time that the samples leave the site at which they were collected. Field personnel will complete all applicable sections of the form. The chain-of-custody forms will be protected from moisture by encasing it in plastic (e.g., Ziplock® plastic bags) and placed inside the shipping containers. The chain-of-custody forms will accompany the containers during shipment to the laboratory.

Field personnel collecting the samples will be responsible for custody until the samples are delivered to the laboratory or relinquished to a commercial shipping company. Sample transfer requires the individuals relinquishing and receiving the samples to sign, date, and note the time of transfer on the chain-of-custody forms. Common carriers (e.g., Federal Express) are not expected to sign the chain-of-custody form. However, the bill of lading or airbill becomes part of the chain-of-custody record when a common carrier is used to transport the samples. The chain-of-custody is considered complete after the analytical laboratory accepts custody of the samples (acceptance of custody is indicated by signature on the chain-of-custody form). A copy of the chain-of-custody record will be maintained by the field personnel along with other field records.

3.3.8 Record Keeping

Field records that are both technically and legally defensible will be maintained for all aspects of ground-water sampling. These records include sample identification labels, chain-of-custody information, and technical field data. Sample labels and chain-of-custody records have already been described separately. Records of technical field data will be kept on preprinted, ground-water sampling field data sheets (Figure 3.1.3.1). Preprinted forms will be used because of the prompting provided, the ease of use, and the consistent format. The field sampling records will include the following information.

- Sampling location
- Date and time
- Condition of the well
- Static water level (depth to water)
- Depth to the bottom of the well
- Calculated well volume
- Purging method
- Actual purged volume
- Sample collection method
- Sample description
- Field meter calibration data
- General comments (weather conditions, etc.)

Data entries will be made using black indelible ink and will be written legibly. Entry errors will be crossed out with a single line, dated, and initialed by the person making the correction.

3.3.9 Equipment Decontamination Procedure

Equipment that will be placed inside the well and is not dedicated to the particular well will be decontaminated prior to use. Dedicated equipment that inadvertently contacts anything other than the inside of the well casing (e.g., unprotected ground surface) will also be decontaminated. This procedure has been developed in accordance with ASTM D 5088-90 "Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites".

Equipment and Materials:

1. Laboratory detergent (Alconox®, Liquinox®, or equivalent)
2. Potable water
3. Deionized Water (Type II, as per ASTM D 1193-77 - reapproved 1983) contained in Teflon® wash bottle.
4. Assorted brushes and buckets.
5. Aluminum foil

Procedure:

- Wash in potable water and laboratory detergent with a brush to remove particles of soil or sediment.
- Equipment with internal mechanisms that cannot be contacted with a brush (e.g., submersible pumps) will be washed by circulating the detergent solution through the equipment.
- Rinse with potable water.
- Rinse with deionized water.
- Allow equipment to air dry to the extent possible.
- Wrap equipment in aluminum foil or polyethylene, unless it is used immediately.

3.4 LABORATORY ANALYSES

3.4.1 Introduction

Ground-water samples will be collected from nine monitoring wells which yield sufficient volume for chemical analysis, as discussed in previous sections. Ten additional wells will be sampled should they begin to yield sufficient volume for analysis. Post-closure monitoring of the Old Erie Landfill will involve sample collection from two additional wells (with two more wells being sampled if they begin to yield sufficient water). The chemical constituents to be analyzed and the analytical methods are discussed in the following sections.

3.4.2 Analytical Constituents

Federal Requirements - The required federal Detection Monitoring constituents are listed in Appendix I of 40 CFR Part 258. This list includes 47 volatile organic compounds and 15 metals. The federal Assessment Monitoring parameter list (Appendix II) consists of an expanded list of constituents, which includes 65 volatile organic compounds, 98 semi-volatile organic compounds, 5 herbicides, 25 pesticides, PCBs, 17 metals, and 2 conventional parameters. The Assessment and Detection Monitoring parameters (Appendix I and II) are listed on Table 3.4.2.1.

State Requirements - The site is located in the State of Colorado which is an approved state. The state has established a list of detection monitoring analytical parameters that must be analyzed in addition to the federal list. The additions to the list include 4 major cations, 6 major anions, total organic carbon (TOC), temperature, pH, and specific conductance (Appendix IA of 6 CCR 1007-2). The remainder of the Detection Monitoring list (Appendix IB) and the Assessment Monitoring list (Appendix II) are the same as the federal lists. An alternative Assessment Monitoring list of parameters may be approved by CDH if it can be demonstrated that certain constituents are not reasonably expected to be in or derived from the site. The Appendix IA parameters are presented in Table 3.4.2.2.

3.4.3 Analytical Methods

Volatile Organic Compounds - The volatile organic constituents will be analyzed by Gas Chromatography/Mass Spectroscopy (GC/MS) and/or Gas Chromatography (GC), depending on the particular compound. The specific method numbers are listed on Table 3.4.2.1.

Semi-Volatile Organic Compounds - The semi-volatile organic constituents will be analyzed by Gas Chromatography/Mass Spectroscopy (GC/MS) and/or Gas Chromatography (GC), depending on the particular compound. The specific method numbers are listed on Table 3.4.2.1.

Pesticides/Herbicides/PCBs - The pesticides/herbicides/PCBs will be analyzed by Gas Chromatography (GC). The specific methods that will be used for each constituents are listed on Table 3.4.2.1.

Metals - Metals will be analyzed by a number of analytical methods including Ion Coupled Plasma (6000 series) and Atomic Absorption (7000 series). The specific methods that will be used for each of the metallic constituents are listed on Tables 3.4.2.1 and 3.4.2.2.

Conventional Parameters - The conventional parameters will be analyzed according to the methodologies listed on Tables 3.4.2.1 and 3.4.2.2. Cations, anions and total organic carbon (as required by the State of Colorado) will be analyzed according to methods outlined in either SW-846 (EPA, 1986b) or EPA (1979).

3.4.4 Quantification Levels

The quantification levels for each analytical constituent are listed on Table 3.4.2.1. The quantification levels are specified on the basis of the practical quantitation limits (PQLs) generally achievable by standard analytical laboratory practices. The PQL is defined as the lowest level that can be reliably achieved within specified limits of precision and accuracy under routine laboratory operating conditions.

3.4.5 Sample Containers, Preservatives, & Holding Times

Samples will be chemically stabilized for transport from the field to the laboratory through the use of the proper sample containers and preservation techniques. In addition, analyses will be performed within the proper holding times. Table 3.3.6.1 lists the specific container and preservative requirements for each parameter group along with the maximum holding times.

3.4.6 Internal Quality Control

Various laboratory Quality Assurance/Quality Control (QA/QC) procedures will be followed, as specified in the previously referenced analytical methods. In addition, a number of (internal) laboratory QA/QC samples will be analyzed, as follows.

QA/QC Sample Type	Parameter	Minimum Frequency
Matrix Spike/Matrix Spike Dup.	Organics & Metals	1 per batch (20 max in batch)
Laboratory Control Sample	Organics & Metals	1 per batch (20 max in batch)
Surrogate Spike Sample	Organics	Every sample
Method Blank Sample	Organics & Metals	1 per batch (20 max in batch)

3.4.7 Laboratory Reporting

The analytical data will be reported by the laboratory through the preparation of the following deliverables.

Sample Reporting Group Transmittal Letter - The transmittal letter will describe special circumstances that were encountered or observations made during the analysis of the related set of samples.

Sample Description - The sample description will contain sample field identification including date and time of sampling and cross reference to applicable laboratory identifiers. This will also include date of sample receipt, date of sample report, and other project control information, as applicable.

Analytical Data Submission - Reporting of results by the laboratory will consist of the following.

a. Sample analytical data report (hard copy) that will contain sample concentrations, equivalent CLP qualifiers, analytical methods and detection limits (as applicable) for each parameter.

b. QA/QC Report (hard copy), to include matrix spike/matrix spike duplicate samples, surrogate samples and laboratory control samples:

   - Spike Concentration
   - Spike Recovery Concentration
   - Spike Recovery Percent
   - Comparison of Recovery to Control Limits

   Blank Samples:

   - Method Blanks
   - Trip Blanks
   - Field Blanks

c. Computer data report, provided either on disk or transmitted via modem. The data format will be comma delimited ASCII. The computer data report will include sample data and the data for blank and field replicate and duplicate samples.

Additional supporting data will not be provided as a routine deliverable. However, the analytical laboratory will retain supporting data for a period of at least seven (7) years. These data will include the following.

Chronology

- Digestion/extraction dates
- Analysis dates and times
- Relevant holding times
- Collection dates

Methodology

- Methods
- Reporting limits (method detection limit)
- Instrument detection limit (where applicable)
- Any clean-up procedures used

Chain-of-Custody & Packaging Documentation

- Discussion of abnormalities, inconsistencies
- Temperature on receipt of sample cooler

3.4.8 Data Quality Evaluation

A data quality evaluation will be conducted. The evaluation will address, at a minimum, the following issues.

- Overall data completeness.
- Analyses flagged with a "B" qualifier, indicating the presence of the compounds in the associated laboratory method blank.
- Compounds found in field blank and trip blank samples.
- Analytes flagged with an "E" qualifier, indicating that the concentrations exceeded the calibration range of the GC/MS instrument.

- Field replicate or duplicate samples.
- Review of laboratory QA/QC samples including comparison of spike recovery percentages to control limits.

3.5 SURFACE WATER MONITORING PROGRAM

Stormwater run-off will be monitored in the sediment basin as required by the federal National Pollutant Discharge Elimination System (NPDES) regulations and applicable state regulations.

3.6 LEACHATE MONITORING PROGRAM

The leachate collection system ultimately will consist of five angled extraction pipes extending from leachate collection sumps; three have been installed and are monitored quarterly. The first leachate sump (Northwest Sump) was installed in accordance with IC (1988a). The second and third leachate sumps (Cell A and B Sumps) were constructed under the current design (Golder, 1991). Sumps will also be installed and monitored in Cells C and D when these cells are constructed.

The leachate sumps will be monitored quarterly for the presence of fluid. If present, the fluid will be sampled for measurement of temperature, pH, and specific conductance. An additional sample of the fluid in the sumps will be collected annually for toxicity characteristic leaching procedure (TCLP) analysis. As long as the TCLP results indicate that the sump fluid in not a hazardous waste, the fluid will be pumped from the sump on a routine basis and recirculated onto the landfill in an area underlain by the composite liner system. Cells A, B, C and D are underlain by a composite liner (including a leachate collection system) designed in accordance with the federal Subtitle D regulations. If the TCLP results indicate that the fluid is hazardous by characteristic, it will be disposed of by an acceptable method.

Table 3.1.2.1. Survey Data

Well	Permit Number	Survey Date	Surveyor	Coordinates Northing (feet)	Coordinates Easting (feet)	Outer Casing Elevation (ft NGVD)	Inner Casing Elevation (ft NGVD)	Ground Elevation (ft NGVD)
P-1	NP	05/18/90	Contract Surveyors, Ltd.	7,837.56	13,671.35	None	5,179.16	5,176.73
P-2	NP	05/18/90	Contract Surveyors, Ltd.	7,356.41	13,093.82	5,149.43	5,148.62	5,146.78
P-3	NP	03/26/94	Greenhorne & O'Mara	8,059.97	11,354.80	5,112.54	5,112.44	5,110.72
P-4	NP	03/26/94	Greenhorne & O'Mara	8,647.86	11,343.08	5,112.00	5,112.01	5,110.05
GW-1	NP	05/18/90	Contract Surveyors, Ltd.	9,757.26	15,021.87	5,248.82	5,248.18	5,245.94
GW-7	NP	05/18/90	Contract Surveyors, Ltd.	9,784.94	15,020.36	5,251.25	5,250.94	5,247.87
GW-8	NP	05/18/90	Contract Surveyors, Ltd.	9,235.55	11,325.62	5,113.66	5,113.04	5,110.70
GW-12	NP	05/18/90	Contract Surveyors, Ltd.	9,961.04	14,112.58	5,226.30	5,226.14	5,224.05
S-101	165430	05/22/91	Contract Surveyors, Ltd.	9,918.12	11,379.71	5,152.16	5,151.69	5,149.82
S-102	165431	05/22/91	Contract Surveyors, Ltd.	9,288.17	11,326.09	5,113.76	5,113.27	5,111.40
S-105	165435	06/07/91	Contract Surveyors, Ltd.	7,377.62	11,673.94	5,122.79	5,122.10	5,120.36
S-106	165427	05/22/91	Contract Surveyors, Ltd.	9,964.86	13,293.61	5,185.81	5,185.23	5,183.40
S-201	165429	05/22/91	Contract Surveyors, Ltd.	9,918.15	11,367.92	5,152.06	5,151.83	5,149.66
S-202	165428	05/22/91	Contract Surveyors, Ltd.	9,271.97	11,325.43	5,113.78	5,113.37	5,111.23
S-203	165434	05/22/91	Contract Surveyors, Ltd.	8,541.71	11,341.09	5,110.70	5,110.53	5,108.41
S-204	165432	03/26/94	Greenhorne & O'Mara	8,098.79	11,354.20	5,112.68	5,112.71	5,110.88
S-205	165433	06/07/91	Contract Surveyors, Ltd.	7,367.77	11,683.09	5,122.57	5,122.33	5,120.33
S-206	165426	05/22/91	Contract Surveyors, Ltd.	9,965.08	13,281.57	5,185.43	5,185.22	5,183.18
S-208	165422	06/07/91	Contract Surveyors, Ltd.	8,428.09	13,954.02	5,213.16	5,212.88	5,211.06
S-209	165423	06/07/91	Contract Surveyors, Ltd.	7,356.24	13,082.33	5,151.51	5,151.28	5,149.19
S-210	168482	06/23/92	Montgomery-Phillips	8,695.90	14,456.00	5,232.17	5,231.73	5,229.90
S-211	MH-21762*	11/30/93	Contract Surveyors, Ltd.	9,249.89	11,327.55	5,113.37	5,113.22	5,111.44
S-212	MH-21762*	11/30/93	Contract Surveyors, Ltd.	9,261.27	11,327.87	5,113.61	5,113.55	5,111.47

Notes:

NP indicates not permitted.
* indicates the file number as registered with the Office of the State Engineer until the well is permitted or abandoned.

Table 3.1.2.2. Well Construction Details

Well	Date Installed	Driller	Well Depth (feet)	Well Dia. (in.)	Boring Dia. (in.)	Depth of Screened Interval (feet)	Depth of Sand Pack Interval (feet)	Depth of Bentonite Seal (feet)	Depth of Grout Seal (feet)
P-1	12/19/89	Boyles	4.60	2	11.25	2.60 - 4.60	2.00 - 4.60	0.00 - 2.00	None
P-2	12/21/89	Boyles	11.25	2	11.25	5.51 - 10.09	4.75 - 11.25	4.00 - 4.75	0.00 - 4.00
P-3	12/20/89	Boyles	39.0	2	11.25	28.4 - 37.8	26.0 - 39.0	24.4 - 26.0	15.0 - 24.4
P-4	12/22/89	Boyles	20.7	2	11.25	17.7 - 20.7	17.3 - 20.7	16.7 - 17.3	13.2 - 16.7
GW-1	09/83	Empire	100	2	6.5	95 - 100	50 - 100	48 - 50	None
GW-7	09/83	Empire	26	2	4	21 - 26	16 - 26	14 - 16	None
GW-8	09/20/83	Empire	30.00	2	4.00	24.50 - 29.50	20.00 - 30.00	18.00 - 20.00	None
GW-12	06/04/87	Fox	71	4	8	61 - 71	9.5 - 71	6.25 - 9.5	0.00 - 6.25
S-101	03/25/91	Boyles	17.00	2	7.25	6.90 - 16.30	5.90 - 17.00	2.46 - 5.90	0.00 - 2.46
S-102	03/22/91	Boyles	22.50	2	7.25	12.40 - 21.50	10.50 - 22.50	2.44 - 10.50	0.00 - 2.44
S-105	03/21/91	Boyles	9.70	2	7.25	5.60 - 9.70	4.50 - 9.70	2.43 - 4.50	0.00 - 2.43
S-106	03/21/91	Boyles	11.20	2	7.25	6.00 - 10.60	5.00 - 11.20	2.39 - 5.00	0.00 - 2.39
S-201	05/03/91	Boyles	144.50	2	5.88	118.92 - 143.42	116.0 - 144.5	114.00 - 116.00	0.00 - 114.00
S-202	04/17/91	Boyles	98.00	2	5.88	92.80 - 97.40	90.10 - 98.00	88.10 - 90.10	0.00 - 88.10
S-203	04/30/91	Boyles	101.48	2	5.88	96.05 - 100.50	94.00 - 101.48	91.97 - 94.00	0.00 - 91.97
S-204	04/25/91	Boyles	103.10	2	5.88	87.80 - 102.00	85.80 - 103.10	83.75 - 85.80	0.00 - 83.75
S-205	04/23/91	Boyles	42.62	2	5.88	34.00 - 42.00	32.93 - 42.62	30.90 - 32.93	0.00 - 30.90
S-206	05/01/91	Boyles	143.97	2	5.88	118.00 - 142.50	116.00 - 143.97	113.95 - 116.00	0.00 - 113.95
S-208	05/08/91	Boyles	148.90	2	5.88	138.35 - 147.80	136.00 - 148.90	133.84 - 136.00	0.00 - 133.84
S-209	04/22/91	Boyles	95.15	2	5.88	84.55 - 94.00	82.50 - 95.15	80.43 - 82.50	0.00 - 80.43
S-210	06/03/92	Hier	178.10	2	6.0	167.78 - 177.83	165.50 - 178.10	162.75 - 165.50	0.00 - 162.75
S-211	11/03/93	Boyles	38.5	2	7.50	28.1 - 38.1	27.3 - 38.5	25.2 - 27.3	0.00 - 25.2
S-212	11/11/93	Boyles	59.0	2	7.50	47.1 - 58.8	43.7 - 59.0	41.7 - 43.7	0.00 - 41.7

Notes:

Well casings consist of PVC pipe.
All depths reference ground surface.

Table 3.1.2.3. Historical Water Level Data

Well Identification: GW-1
Measuring Point Elevation: 5,248.18

Date	Time	Depth to Water (ft)	Water Level Elevation (ft)
04/26/89	04:30 PM	77.93 p	5,170.25
07/26/89	05:45 PM	78.00 p	5,170.18
09/21/89	10:11 AM	77.23 p	5,170.95
12/26/89	04:40 PM	76.23 p	5,171.95
03/30/90	04:59 PM	75.73 p	5,172.45
06/18/90	-	73.39 p	5,174.79
09/25/90	09:42 AM	71.30 p	5,176.88
12/07/90	09:16 AM	71.39 p	5,176.79
03/20/91	04:34 PM	72.46 p	5,175.72
06/18/91	11:39 AM	73.37 e	5,174.81
09/12/91	04:49 PM	70.77 e	5,177.41
12/22/91	03:15 PM	70.81 e	5,177.37
03/23/92	02:24 PM	72.05 e	5,176.13
06/22/92	04:06 PM	71.22 e	5,176.96
09/02/92	09:58 AM	70.83 e	5,177.35
12/15/92	11:34 AM	70.15 e	5,178.03
03/03/93	03:42 PM	70.47 e	5,177.71
06/03/93	09:29 AM	70.76 e	5,177.42
09/08/93	12:40 PM	70.61 e	5,177.57
12/03/93	09:54 AM	70.04 e	5,178.14
03/01/94	10:45 AM	70.10 e	5,178.08
06/01/94	04:35 PM	70.00 e	5,178.18

Notes:

- indicates not available.
p indicates the water level measurement taken with plopper.
e indicates electronic water level measuring instrument.

Table 3.1.2.3. Historical Water Level Data (continued)

Well Identification: GW-8
Measuring Point Elevation: 5,113.04

Date	Time	Depth to Water (ft)	Water Level Elevation (ft)
04/26/89	03:30 PM	23.02 p	5,090.02
07/27/89	05:45 AM	24.10 p	5,088.94
09/21/89	10:50 AM	23.92 p	5,089.12
12/26/89	03:23 PM	24.64 p	5,088.40
03/31/90	09:18 AM	24.15 p	5,088.89
06/18/90	-	24.83 p	5,088.21
09/24/90	04:14 PM	26.24 p	5,086.80
12/06/90	03:13 PM	29.14 p	5,083.90
03/20/91	02:51 PM	31.24 p	5,081.80
06/18/91	03:59 PM	30.93 p	5,082.11
09/12/91	02:32 PM	30.36 e	5,082.68
12/22/91	01:20 PM	29.86 e	5,083.18
03/30/92	08:10 AM	29.11 e	5,083.93
06/23/92	11:41 AM	26.93 e	5,086.11
09/02/92	12:11 PM	29.67 e	5,083.37
12/15/92	09:20 AM	28.87 e	5,084.17
03/03/93	01:35 PM	30.60 e	5,082.44
06/02/93	11:53 AM	30.75 e	5,082.29
09/03/93	02:06 PM	30.98 e	5,082.06
12/02/93	01:55 PM	30.76 e	5,082.28
03/01/94	02:45 PM	30.79 e	5,082.25
06/01/94	10:20 AM	30.90 e	5,082.14

Notes:

- indicates not available.
p indicates the water level measurement taken with plopper.
e indicates electronic water level measuring instrument.

Table 3.1.2.3. Historical Water Level Data (continued)

Well Identification: P-2
Measuring Point Elevation: 5,148.62

Date	Time	Depth to Water (ft)	Water Level Elevation (ft)
06/18/90	-	4.71 p	5,143.91
09/25/90	09:01 AM	8.10 p	5,140.52
12/07/90	08:17 AM	9.72 p	5,138.90
03/20/91	03:46 PM	10.20 p	5,138.42
06/18/91	01:38 PM	8.96 p	5,139.66
09/12/91	11:56 AM	8.59 e	5,140.03
12/22/91	02:13 PM	9.61 e	5,139.01
03/24/92	10:37 AM	8.01 e	5,140.61
06/23/92	03:09 PM	6.71 e	5,141.91
09/02/92	-	9.29 e	5,139.33
12/15/92	10:39 AM	10.83 e	5,137.79
03/03/93	02:52 PM	11.40 e	5,137.22
06/02/93	03:02 PM	11.34 e	5,137.28
09/08/93	11:48 AM	11.02 e	5,137.60
12/02/93	03:55 PM	11.34 e	5,137.28
03/01/94	12:45 PM	11.43 e	5,137.19
06/01/94	02:40 PM	11.34 e	5,137.28

Well Identification: P-3
Measuring Point Elevation: 5,102.17

Date	Time	Depth to Water (ft)	Water Level Elevation (ft)
06/18/90	-	29.38 p	5,072.79
09/25/90	08:49 AM	28.92 p	5,073.25
12/07/90	07:59 AM	29.74 p	5,072.43
03/20/91	03:34 PM	29.79 p	5,072.38
06/18/91	02:41 PM	Dry e	-
09/12/91	01:02 PM	28.71 e	5,073.46
12/22/91	01:49 PM	28.14 e	5,074.03
03/23/92	04:02 PM	27.69 e	5,074.48
06/23/92	01:05 PM	28.05 e	5,074.12
09/02/92	02:12 PM	27.76 e	5,074.41
12/15/92	10:00 AM	27.00 e	5,075.17
03/03/93	02:14 PM	28.08 e	5,074.09
06/02/93	01:59 PM	28.16 e	5,074.01
09/08/93	10:46 AM	28.37 e	5,073.80
12/02/93	03:02 PM	28.42 e	5,073.75
03/01/94	01:45 PM	28.39 e	5,073.78
New Measuring Point Elev.:	5,112.44		
06/01/94	12:30 PM	39.50 e	5,072.94

Notes:
- indicates not available.
p indicates the water level measurement taken with plopper.
e indicates electronic water level measuring instrument.

Table 3.1.2.3. Historical Water Level Data (continued)

Well Identification: P-4
Measuring Point Elevation: 5,098.04

Date	Time	Depth to Water (ft)	Water Level Elevation (ft)
06/18/90	-	8.51 p	5,089.53
09/24/90	04:46 PM	8.17 p	5,089.87
12/07/90	07:34 AM	8.71 p	5,089.33
03/20/91	03:17 PM	8.73 p	5,089.31
06/18/91	03:23 PM	Dry e	-
09/12/91	01:54 PM	Dry e	-
12/22/91	01:40 PM	Dry e	-
03/23/92	03:28 PM	Dry e	-
06/23/92	12:23 PM	Dry e	-
09/02/92	12:48 PM	7.15 e	5,090.89
12/15/92	09:37 AM	8.88 e*	5,089.16
03/03/93	01:45 PM	8.88 e*	5,089.16
06/02/93	01:08 PM	Dry e	-
09/08/93	10:02 AM	8.88 e*	5,089.16
12/02/93	02:25 PM	Dry e	-
03/02/94	08:30 AM	Dry e	-
New Measuring Point Elev.:	5,112.01		
06/01/94	10:40 AM	22.62 e	5,089.39

Well Identification: S-202
Measuring Point Elevation: 5,113.37

Date	Time	Depth to Water (ft)	Water Level Elevation (ft)
06/18/91	04:21 PM	Dry e	-
09/12/91	02:49 PM	99.87 e	5,013.50
12/22/91	01:16 PM	99.67 e	5,013.70
03/30/92	08:18 AM	Dry e	-
06/23/92	11:32 AM	Dry e	-
09/02/92	12:03 PM	Dry e	-
12/15/92	09:14 AM	Dry e	-
03/03/93	01:25 PM	99.85 e*	5,013.52
06/02/93	11:44 AM	Dry e	-
09/03/93	02:01 PM	99.85 e*	5,013.52
12/02/93	01:18 PM	99.67 e	5,013.70
03/01/94	03:15 PM	99.68 e	5,013.69
06/01/94	09:50 AM	99.67 e	5,013.70

Notes:
- indicates not available.
p indicates the water level measurement taken with plopper.
e indicates electronic water level measuring instrument.
* indicates depth to water equals total depth of well.

Table 3.1.2.3. Historical Water Level Data (continued)

Well Identification: S-203
Measuring Point Elevation: 5,110.53

Date	Time	Depth to Water (ft)	Water Level Elevation (ft)
06/18/91	03:15 PM	101.25 e	5,009.28
09/12/91	01:39 PM	101.29 e	5,009.24
12/22/91	01:38 PM	101.15 e	5,009.38
03/23/92	03:37 PM	101.18 e	5,009.35
06/23/92	12:30 PM	101.16 e	5,009.37
09/02/92	01:18 PM	101.32 e	5,009.21
12/15/92	09:45 AM	101.12 e	5,009.41
03/03/93	01:54 PM	101.12 e	5,009.41
06/02/93	01:24 PM	101.23 e	5,009.30
09/08/93	10:18 AM	101.34 e	5,009.19
12/02/93	02:36 PM	101.33 e	5,009.20
03/01/94	02:20 PM	101.12 e	5,009.41
06/01/94	11:15 AM	101.38 e	5,009.15

Well Identification: S-204
Measuring Point Elevation: 5,111.55

Date	Time	Depth to Water (ft)	Water Level Elevation (ft)
06/18/91	02:54 PM	88.77 e	5,022.78
09/12/91	01:25 PM	88.12 e	5,023.43
12/22/91	01:48 PM	87.87 e	5,023.68
03/23/92	03:50 PM	87.70 e	5,023.85
06/23/92	12:50 PM	87.86 e	5,023.69
09/02/92	02:02 PM	87.47 e	5,024.08
12/15/92	09:48 AM	86.89 e	5,024.66
03/03/93	02:03 PM	87.37 e	5,024.18
06/02/93	01:42 PM	87.42 e	5,024.13
09/08/93	10:30 AM	88.02 e	5,023.53
New Measuring Point Elev.:	5,111.51		
12/02/93	02:49 PM	87.94 e	5,023.57
03/01/94	02:00 PM	88.34 e	5,023.17
New Measuring Point Elev.:	5,112.71		
06/01/94	12:10 PM	90.17 e	5,022.54

Notes:
- indicates not available.
p indicates the water level measurement taken with plopper.
e indicates electronic water level measuring instrument.

Table 3.1.2.3. Historical Water Level Data (continued)

Well Identification: S-205
Measuring Point Elevation: 5,122.44

Date	Time	Depth to Water (ft)	Water Level Elevation (ft)
06/18/91	02:13 PM	37.36 p	5,085.08
09/12/91	11:35 AM	36.24 e	5,086.20
12/22/91	02:03 PM	35.85 e	5,086.59
03/23/92	04:25 PM	35.68 e	5,086.76
06/23/92	01:37 PM	35.83 e	5,086.61
09/02/92	02:49 PM	37.34 e	5,085.10
12/15/92	10:24 AM	35.98 e	5,086.46
03/03/93	02:31 PM	33.64 e	5,088.80
06/02/93	02:28 PM	35.95 e	5,086.49
09/08/93	11:17 AM	32.56 e	5,089.88
New Measuring Point Elev.:	5,122.33		
12/02/93	03:25 PM	31.21 e	5,091.12
03/01/94	01:15 PM	31.46 e	5,090.87
06/01/94	01:00 PM	31.51 e	5,090.82

Well Identification: S-208
Measuring Point Elevation: 5,212.99

Date	Time	Depth to Water (ft)	Water Level Elevation (ft)
06/18/91	12:51 PM	145.99 e	5,067.00
09/12/91	12:27 PM	144.41 e	5,068.58
12/22/91	02:33 PM	144.37 e	5,068.62
03/24/92	11:11 AM	144.45 e	5,068.54
06/23/92	03:58 PM	144.88 e	5,068.11
09/02/92	04:02 PM	145.20 e	5,067.79
12/15/92	10:53 AM	145.94 e	5,067.05
03/03/93	03:08 PM	145.14 e	5,067.85
06/02/93	03:49 PM	149.56 e	5,063.43
09/03/93	02:48 PM	149.98 e	5,063.01
New Measuring Point Elev.:	5,212.88		
12/02/93	04:19 PM	149.93 e	5,062.95
03/01/94	12:10 PM	149.72 e	5,063.16
06/01/94	03:25 PM	149.70 e	5,063.18

Notes:
- indicates not available.
p indicates the water level measurement taken with plopper.
e indicates electronic water level measuring instrument.

Table 3.1.2.3. Historical Water Level Data (continued)

Well Identification: S-209
Measuring Point Elevation: 5,151.32

Date	Time	Depth to Water (ft)	Water Level Elevation (ft)
06/18/91	01:49 PM	81.89 e	5,069.43
09/12/91	11:43 AM	81.99 e	5,069.33
12/22/91	02:12 PM	81.97 e	5,069.35
03/24/92	10:24 AM	82.23 e	5,069.09
06/23/92	03:01 PM	82.30 e	5,069.02
09/02/92	03:05 PM	81.42 e	5,069.90
12/15/92	10:34 AM	81.91 e	5,069.41
03/03/93	02:44 PM	82.16 e	5,069.16
06/02/93	02:42 PM	82.17 e	5,069.15
09/08/93	11:30 AM	82.23 e	5,069.09
New Measuring Point Elev.:	5,151.28		
12/02/93	03:40 PM	82.05 e	5,069.23
03/01/94	12:55 PM	82.09 e	5,069.19
06/01/94	02:20 PM	82.17 e	5,069.11

Well Identification: S-210
Measuring Point Elevation: 5,231.73

Date	Time	Depth to Water (ft)	Water Level Elevation (ft)
06/22/92	03:43 PM	164.67 e	5,067.06
09/02/92	09:40 AM	164.67 e	5,067.06
12/15/92	11:24 AM	164.61 e	5,067.12
03/03/93	03:49 PM	164.89 e	5,066.84
06/03/93	09:40 AM	164.78 e	5,066.95
09/08/93	12:56 PM	165.09 e	5,066.64
12/03/93	09:40 AM	165.21 e	5,066.52
03/01/94	10:20 AM	165.28 e	5,066.45
06/01/94	04:15 PM	165.26 e	5,066.47

Well Identification: S-211
Measuring Point Elevation: 5,113.22

Date	Time	Depth to Water (ft)	Water Level Elevation (ft)
12/02/93	01:44 PM	20.54 e	5,092.68
03/01/94	02:55 PM	33.84 e	5,079.38
06/01/94	10:10 AM	38.07 e	5,075.15

Notes:
- indicates not available.
p indicates the water level measurement taken with plopper.
e indicates electronic water level measuring instrument.

Table 3.1.2.4. Summary of Well Recovery Rates

Well No.	Date of Recovery Record	Type of Record	Static Water Level (feet)	Pumping Rate (gpm)	Pumping Time (minutes)	Water Level after Pumping (feet)	Recovery Time (minutes)	Recovery (%)
P-1	-	-	-	-	-	-	-	-
P-2	-	-	-	-	-	-	-	-
P-3	-	-	-	-	-	-	-	-
P-4	-	-	-	-	-	-	-	-
GW-1	-	-	-	-	-	-	-	-
GW-7	-	-	-	-	-	-	-	-
GW-8	-	-	-	-	-	-	-	-
GW-12	-	-	-	-	-	-	-	-
S-101	-	-	-	-	-	-	-	-
S-102	-	-	-	-	-	-	-	-
S-105	-	-	-	-	-	-	-	-
S-106	-	-	-	-	-	-	-	-
S-201	-	-	-	-	-	-	-	-
S-202	-	-	-	-	-	-	-	-
S-203	06/12/91	Development	101.24	0.007	26	102.95	72	100
S-204	06/07/91	Development	88.21	0.13	309	101.00	156	59
S-205	06/10/91	Development	35.91	0.081	78	43.40	101	62
S-206	-	-	-	-	-	-	-	-
S-208	06/06/91	Development	144.39	0.053	34	148.80	5,384	81
S-209	06/10/91	Development	81.87	0.20	97	83.86	272	78
S-210	-	-	-	-	-	-	-	-
S-211	06/12/91	Development	36.89	0.016	29	39.26	5,782	85
S-212	-	-	-	-	-	-	-	-

Notes:

- indicates data not available.

Table 3.1.2.5. History of Wells

Well Number	Monitoring Purpose of Well	Drilling Contractor	Date Installed	Drilling Method	Inspector/ Supervisor	Development Dates	Development Method	Development Rate (gpm)	Packer Testing Date	Well Maintenance	Current Monitoring Status
P-1	WQ, WL	Boyles	12/19/89	HSA	Doty	N/A	N/A	N/A	Not tested	Routine	Dry
P-2	WQ, WL	Boyles	12/21/89	HSA	Doty	Not Developed	N/A	N/A	Not tested	Routine	Sampled 06/94
P-3	WQ, WL	Boyles	12/20/89	HSA	Doty	Not Developed	N/A	N/A	Not tested	03/94 E	Sampled 06/94
P-4	WQ, WL	Boyles	12/22/89	HSA	Doty	N/A	N/A	N/A	Not tested	03/94 E	Dry
GW-1	WQ, WL	Empire	09/83	HSA	Nelson Eng.	Not Avail.	Not Avail.	Not Avail.	Not tested	Routine	Sampled 06/94
GW-7	WQ, WL	Empire	09/83	Auger	Nelson Eng.	N/A	N/A	N/A	Not tested	Routine	Dry
GW-8	WQ, WL	Empire	09/20/83	Auger	Nelson Eng.	Not Avail.	Not Avail.	Not Avail.	Not tested	Routine	Sampled 06/94
GW-12	WQ, WL	Fox	06/04/87	HSA	Nelson Eng.	N/A	N/A	N/A	Not tested	Routine	Dry
S-101	WQ, WL	Boyles	03/25/91	HSA	Golder/Doty	N/A	N/A	N/A	Not tested	Routine	Dry
S-102	WQ, WL	Boyles	03/22/91	HSA	Golder/Doty	N/A	N/A	N/A	Not tested	Routine	Dry
S-105	WQ, WL	Boyles	03/21/91	HSA	Golder/Doty	N/A	N/A	N/A	Not tested	Routine	Dry
S-106	WQ, WL	Boyles	03/21/91	HSA	Golder/Doty	N/A	N/A	N/A	Not tested	Routine	Dry
S-201	WQ, WL	Boyles	05/03/91	HSA/Core	Golder/Doty	N/A	N/A	N/A	Not tested	Routine	Dry
S-202	WQ, WL	Boyles	04/17/91	HSA/Core	Golder/Doty	N/A	N/A	N/A	Not tested	Routine	Normally Dry
S-203	WQ, WL	Boyles	04/30/91	HSA/Core	Golder/Doty	06/7-12/91	Bailing	0.007	04/26-29/91	08/91 SC	Sampled 06/94
S-204	WQ, WL	Boyles	04/25/91	HSA/Core	Golder/Doty	06/07/91	Bailing	0.13	04/24/91	03/94 E	Sampled 06/94
S-205	WQ, WL	Boyles	04/23/91	HSA/Core	Golder/Doty	06/6-11/91	Bailing	0.081	Not tested	Routine	Sampled 06/94
S-206	WQ, WL	Boyles	05/01/91	HSA/Core	Golder/Doty	N/A	N/A	N/A	Not tested	Routine	Dry
S-208	WQ, WL	Boyles	05/08/91	HSA/Core	Golder/Doty	06/6-12/91	Bailing	0.053	05/6-7/91	Routine	Sampled 06/94
S-209	WQ, WL	Boyles	04/22/91	HSA/Core	Golder/Doty	06/7-10/91	Bailing	0.20	04/17-18/91	Routine	Sampled 06/94
S-210	WQ, WL	Heir	06/03/92	Air Rotary	Doty	06/25-29/92	Bailing	Not Avail.	Not tested	Routine	Sampled 06/94
S-211	WQ, WL	Boyles	11/03/93	HSA	Doty	12/93-01/94	Bailing	0.16	Not tested	Routine	Sampled 06/94
S-212	WQ, WL	Boyles	11/11/93	HSA/Core	Doty	N/A	N/A	N/A	11/10-11/93	Routine	Dry

Notes:

WQ - indicates water quality monitoring
WL - indicates water level monitoring
HSA - indicates hollow stem auger
E - indicates well extended to conform with ground surface
SC - indicates surface casing replaced
N/A - indicates not applicable
Routine well maintenance consists of cleanup and replacement of surface completion materials

Table 3.3.3.1. Summary of Well Purging Equipment

Description	Pumping Rate (gpm)	Well Diam. (inches)	Depth Limit (feet)	Can it be Dedicated?	Materials	Advantages	Disadvantages	Manufacturers
Bladder Pump								
Tube housing non gas contact, pressurized, collapsible membrane	0.5-2	2-4	150-400	Yes	SS/Teflon PVC	Moderate pump rate Good control of pump rate Can purge >200' Easily disassembled Easy to operate	Deep sampling reduces efficiency High capital cost Can fail in high TSS water	QED, Geogard, Isco
Small Diameter (2") Electric Submersible Pump								
Electrically driven impeller pump.	0.1-9	2-4	75-300	Yes	SS/Teflon	Relatively high pump rate Effective for deep well purging	Requires power source High capital cost Deep sampling reduces efficiency	Grundfos, Fultz
Centrifugal (Suction) Pump								
2 cycle gasoline engine driven, centrifugal pump.	3-8	Unlimited	$\pm$25	Tubing only	Plastic	High pump rate Flow easily controlled Inexpensive Portable Self powered	Gasoline engine can impact VOCs 2 cycle engines temperamental May require priming	McCulloch, Honda, Homelite
Peristaltic (Suction) Pump								
Elastic tubing that is sequentially squeezed by rollers.	1-3	<=2	$\pm$25	Yes, internal elastic tubing & pump tubing	Teflon HDPE PP	Flow easily controlled Portable Inexpensive Relatively simple	Requires power source Slow purging rate	Isco, Masterflex

Table 3.3.3.2. Summary of Well Sampling Equipment

Description	Well Diam. (inches)	Depth Limit (feet)	Can it be Dedicated?	Materials	Reduce Flow to 100 ml/m?	OK for: VOCs	OK for: pH Sensi.	Advantages	Disadvantages	Manufacturers
Bailer										
Tube with bottom and/or top check valve, suspended by line.	Unlimited	Unlimited	Yes	PVC Teflon• HDPE SS	Yes	Yes	Yes	Simple, inexpensive Can yield high quality samples if used carefully No power required Easily cleaned	Awkward to use Can aerate sample if not used carefully Increases chance of turbid samples Flow not continuous	Timco, Johnson, Voss
Bladder Pump										
Tube housing gas pressurized, collapsible membrane.	2-4	400	Yes	SS/Teflon• PVC	Some models	Yes	Yes	No contact with drive gas Very easy to operate	High capital cost Can fail in high TSS water	QED, Geogard, Isco
Small Diameter (2") Electric Submersible Pump										
Electrically driven impeller pump.	2-4	400	Yes	SS/Teflon•	Yes	Yes	Yes	Easy to operate Easy to control Continuous flow	High capital cost Awkward if not dedicated	Grundfos

TABLE 3.3.6.1. Containers, Preservation & Holding Times

Analytical Parameter	Typical[a,e] Volume Required (ml)	Container[a]	Preservative	Maximum Holding Time
Volatile Organic Compounds (VOCs)	25-120	G/vial, Teflon®-lined septum	Cool, 4°C & HCl to pH<2[c,d]	14 days
Extractable Organic Compounds (BNAs)	1000-2000	G/Teflon®-lined cap	Cool, 4°C	7 days/extraction +40 days/analysis
Pesticides, Herbicides & Total Organic Halides (TOH)	1000-4000	G/Teflon®-lined cap	Cool, 4°C	7 days/extraction +40 days/analysis
Metals[b] (except Hg and Cr^{+6})	1000-2000	P/G (special acid cleaning)	HNO_3 to pH<2	6 months
Mercury[b]	300-500	P/G (special acid cleaning)	HNO_3 to pH<2 & 0.05% $K_2Cr_2O_7$	28 days
Conventional Parameters				
Cyanide	1000	P	NaOH, pH>12, 4°C	14 days
Sulfate	100-500	P/G	Cool, 4°C	28 days

Notes:

Sources: EPA
ASTM D-4448-85

a. Polyethylene (P) or Glass (G) or Amber Glass (AG).
b. "Dissolved" metals samples should be field filtered prior to preservation.
c. Samples receiving no pH adjustment must be analyzed within 7 days.
d. 0.008 percent $Na_2S_2O_3$ should be added in the presence of residual chlorine.
e. Analytical laboratory should be consulted for specific volume requirements.

Table 3.4.2.1. List of Analytical Parameters

Chemical Constituent	List (a)	CAS Number	Compound Group	Analytical Method (b)		PQL (c) (µg/L)
Cyanide	II	57-12-5	Conventional	9010	Colorimetric	*200*
Sulfide	II	18496-25-8	Conventional	9030	Titration	*4000*
2,4,5-T	II	93-76-5	Herbicide	8150	GC	*2*
2,4,5-Trichlorophenol	II	95-95-4	Herbicide	8270	GC/MS	*10*
2,4-D	II	94-75-7	Herbicide	8150	GC	*10*
Dinoseb	II	88-85-7	Herbicide	8150	GC	*1*
Dinoseb	II	88-85-7	Herbicide	8270	GC/MS	*20*
Silvex	II	93-72-1	Herbicide	8150	GC	*2*
Antimony	I & II	N/A	Metal	6010	ICP	*300*
Antimony	I & II	N/A	Metal	7040	AA, (DA)	*2000*
Antimony	I & II	N/A	Metal	7041	AA, (Furn)	*30*
Arsenic	I & II	N/A	Metal	6010	ICP	*500*
Arsenic	I & II	N/A	Metal	7060	AA, (Furn)	*10*
Arsenic	I & II	N/A	Metal	7061	AA, (GH)	*20*
Barium	I & II	N/A	Metal	6010	ICP	*20*
Barium	I & II	N/A	Metal	7080	AA, (DA)	*1000*
Beryllium	I & II	N/A	Metal	6010	ICP	*3*
Beryllium	I & II	N/A	Metal	7090	AA, (DA)	*50*
Beryllium	I & II	N/A	Metal	7091	AA, (Furn)	*2*
Cadmium	I & II	N/A	Metal	6010	ICP	*40*
Cadmium	I & II	N/A	Metal	7130	AA, (DA)	*50*
Cadmium	I & II	N/A	Metal	7131	AA, (Furn)	*1*
Chromium	I & II	N/A	Metal	6010	ICP	*70*
Chromium	I & II	N/A	Metal	7190	AA, (DA)	*500*
Chromium	I & II	N/A	Metal	7191	AA, (Furn)	*10*
Cobalt	I & II	N/A	Metal	6010	ICP	*70*
Cobalt	I & II	N/A	Metal	7200	AA, (DA)	*500*
Cobalt	I & II	N/A	Metal	7201	AA, (Furn)	*10*
Copper	I & II	N/A	Metal	6010	ICP	*60*
Copper	I & II	N/A	Metal	7210	AA, (DA)	*200*
Copper	I & II	N/A	Metal	7211	AA, (GF)	*10*
Lead	I & II	N/A	Metal	6010	ICP	*400*
Lead	I & II	N/A	Metal	7420	AA, (DA)	*1000*
Lead	I & II	N/A	Metal	7421	AA, (Furn)	*10*
Mercury	II	N/A	Metal	7470	Cold Vapor	*2*
Nickel	I & II	N/A	Metal	6010	ICP	*150*
Nickel	I & II	N/A	Metal	7520	AA, (DA)	*400*
Selenium	I & II	N/A	Metal	6010	ICP	*750*
Selenium	I & II	N/A	Metal	7740	AA, (Furn)	*20*